

Pegmatite emplacement and regional deformation: the Variscan Cap de Creus pegmatite field (Eastern Pyrenees)

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Granitic pegmatites are the products of extreme liquid differentiation that concentrates incompatible elements (rare metals, alkali and fluxes P, B, F, Li, etc) either by low degree of partial melting ('first-drop') or by high degree of fractional crystallization ('last-drop'). The Cap de Creus area is a strategic zone to investigate pegmatite-hosted rare-element mineralization in relation with the structural context of pegmatite emplacement. The area offers an exceptional outcrop quality and its geological context, both in terms of deformation events and pegmatite mineralogy, is well constrained. The area is characterized by a pegmatite field of hundreds of bodies that display a gradient of differentiation correlated with the metamorphic grade and the finite strain rate of the country rocks.

The results of our field, structural, textural and petrological studies show that: 1/ Pegmatites were emplaced over several million years during most of the main Variscan regional deformation event (D2), with a duration of several million years. 2/ At first order, the oldest pegmatites, emplaced at the onset of D2, are the most evolved ones whereas pegmatites emplaced during middle to late D2 are generally less evolved. 3/ In the anatectic area, field relationships show a clear link between migmatite leucosomes and the least-evolved pegmatites at various scale, a feature already noticed by Druguet and Hutton (1998). 4/ Our mineralogical, structural and textural studies reveal significant discordance between the deduced diversity of Cap de Creus pegmatite types and the previously published four different pegmatite mineralogical types.

The progressive emplacement of pegmatites during D2, and thus potentially during a few Myrs, is hardly compatible with the evolution of pegmatitic magma by fractional crystallization of a standard peraluminous granite. Moreover, the fact that the youngest injected pegmatites are generally not the most evolved question the granitic 'last-drop' model. Our data consequently questions the petrological link between the different mineralogical groups of pegmatites, and particularly the model of their 'granitic' origin. This might seem as a paradox, but many differentiated pegmatites are apparently not genetically linked to the less differentiated ones. This does not preclude a common origin for all pegmatites by partial melting of the metapelites at different times and at different structural levels. Our study shows that a detailed structural analysis is necessary to constrain the relative chronology of pegmatite injection, and could give a critical template for petrogenetic model.

Mots-Clés : magma emplacement, regional deformation, pegmatite, mineralization